REMARKS

Applicants respectfully request consideration of the claims in view of the following supplemental remarks. Claims 1-7 and 9-20 are pending. Claim 1 was amended in the response filed on February 2, 2012. Claims 14-20 have been withdrawn as being directed to a non-elected invention. No amendments to the claims are made in the present paper. Applicants submit the claims are in condition for allowance in view of the remarks presented herein.

Examiner Interview

On March 16, 2012, Applicants' respresentative Eric DeMaster (Reg. No. 55,107) contacted Examiner Horning by telephone to discuss the application. Differences between the claims and the Linden, Hass, and Goodwin references were discussed. No agreement was reached with respect to allowable subject matter. Applicants thank the Examiner for the opportunity to discuss the application.

Rejection under 35 U.S.C. § 103

1. Claims 1-7 and 9-13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Haas (Surface and Coatings Technology, 1999, 111:72-79) in view of Linden (W003/066933) in view of Goodwin (W003/086031). Applicants respectfully traverse this rejection.

To make a *prima facie* case of obviousness, all the limitations of the claims must be taught or suggested in the references cited in the Office Action and all the teachings of the prior art need to suggest the claimed subject matter to the person of ordinary skill in the art. *In re Kotzab,* 217 F.3d 1365, 1370 (Fed. Cir. 2000). As articulated by the Supreme Court, a combination is obvious if it is no more than the predictable use of known elements according to their established functions; and there is a reason to combine the known elements. *KSR Intl Co. v. Teleflex, Inc.,* 550 U.S. 398 (2007). "[I]t remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed." *Id.* Applicants submit that the Office Action has not established the required *prima facie* case, as the cited references, either alone or in combination, do not teach or suggest all the claim limitations and fail to establish that one of skill in the art in view of the cited combination of references had a reasonable expectation of successfully arriving at the claims.

Claim 1 recites a method for coating a substrate with an inorganic-organic hybrid polymer material. The method includes steps of introducing a sample in the space between two electrodes, controlling the atmosphere between the electrodes, generating a plasma discharge between the electrodes, and mixing aerosols containing hybrid organic/inorganic cross-linked pre-polymers formed via sol-gel processing, into the plasma discharge, wherein said plasma is generated by a Dielectric Barrier Discharge (DBD) technique.

Haas discloses the combination of ORMOCER ® layers with vapor deposited inorganic thin films (e.g. SiOx). See Abstract and right column of page 72, second paragraph. Haas discloses the coating of vapor-deposited inorganic thin films (e.g. Si0) with ORMOCER ® layers applied by wet chemical processing to form inorganic thin films. The use of ORMOCER®'s as top layers of SiOx-coated OPP and their influence on the oxygen permeability is shown in Fig. 8.

Haas **does not** disclose or suggest plasma coating of ORMOCER® layers. In Haas, vapor-deposited inorganic thin films (e.g. Si0,) are coated with ORMOCER® lacquer using conventional coating techniques, such as dip-coating, spray-coating, and spincoating, and can be cured by heating (typically 1 hour at 130°C) or UV irradiation. See Abstract and left column of page 75, second paragraph. Haas does not disclose thermal of UV energies, which would dissociate the spray-coated precursor materials. In the curing process, certain groups in the oligomers of the ORMOCER® lacquer are thermally activated or activated by the absorption of UV-radiation such that these participate in polymerization and/or cross-linking processes, which is not preceded by any decomposition of the components of the coating composition during these activation processes. Haas does not disclose or suggest coating vapor deposited inorganic thin films (e.g. SiO,c) with ORMOCER® using a plasma deposition process. Only conventional coating techniques, such as dip-coating, spray-coating, and spin-coating, are disclosed with respect to the ORMOCER ® layers. The Office Action acknowledges at page 3 that Haas does not disclose spraying the prepolymer through a plasma.

The Office Action incorrectly implies at page 3 that Haas teaches that dissociation takes place during the coating of the sol-gel mixture on the silica substrate:

"Haas is directed towards making inorganic-organic hybrid polymer material coatings (ORMOCER®s) via a vapor phase deposition process (Section 1: Introduction). It teaches making these films by a hybrid process where a liquid phase process first forms organic/inorganic cross-linked prepolymers by sol-gel processing. Then <u>the material is spray deposited onto a substrate where it is</u>

> further disassociated and then crosslinked by using heat or light to create the desired degree of crosslinking and as a result the desired properties in the film (Section 2 and figure 2)."(emphasis added).

One of skill in the art would recognize that dissociation of the components does not take place in the coating processes (e.g., dip-coating, spray-coating, and spin-coating) or in the cross-linking processes disclosed in Haas. The coating processes disclosed in Haas simply result in evaporation of any volatile liquid present. In Haas, further polymerization and crosslinking takes place in the deposited layer upon heating or exposure to UV-light whereupon certain groups in the oligomers of the ORMOCER® lacquer become thermally activated or activated by the absorption of UV-radiation such that these participate in polymerization and/or cross-linking processes. One skilled in the art would know that the thermal and UV energies disclosed in Hass would be insufficient to dissocaited the spray-caoted precursor materials. Dissociation during the coating of the sol-gel mixture on the silica substrate is neither disclosed nor suggested by Haas.

At page 3, the Office Action alleges that Linden discloses plasma activated vapor deposition of inorganic-organic hybrid polymer material and that this process avoids the many processing steps, long curing periods, prolonged preserving steps and large amounts of solvents associated with spraying and curing methods. The examinier contends that it would have been obvious to one of skill in the art to modify the process disclosed in Haas to replace spraying and curing with vapor plasma deposition of the inorganic-organic hybrid polymer material as disclosed in Linden. Applicants do not agree.

A rejection cannot be predicated on the mere identification of individual components of the claimed invention. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also contains a motivation or suggestion to modify or combine the references. *In re Mills,* 916 F.2d 680, 682 (Fed. Cir. 1990). Particular findings must be made as to the reason the skilled artisan, with no known knowledge of the claimed invention, would have selected these components for combination in the manner claimed." *Ecolochem Inc. v. Southern Calif. Edison Co.,* 227 F3d 1361, 1375 (Fed. Cir. 2000).

Linden teaches a chemical vapour deposition process and not a plasma deposition process. Linden discloses at page 2, lines 13-27, that:

> "Surprisingly, it has been found that an improvement for the wet- chemical coating method from the prior art can be obtained by making use of plasma activated deposition of the hybrid material from a chemical vapor phase, whereby nanoparticles are captured in the coating. A hybrid coating consisting of an organic and an inorganic component having improved wear properties could be manufactured inter alia by a process of chemical vapor deposition or CVD with two separate plasmas.
> The present invention relates to a method for applying a hybrid coating to a substrate, which coating comprises an inorganic and an organic component and which inorganic component comprises nanoparticles, wherein precursors for these components are activated in one or more plasma sources for plasma activated deposition of a chemical vapor phase and wherein the activated precursors are combined before they are deposited on the substrate from the chemical vapor phase for forming the coating."

This process is intrinsically different from a plasma process in that a chemical vapour phase is produced rather than dispersion of a species in a plasma. As discussed in a previous response, the term "chemical vapour deposition" is understood by one of skill in the art to mean growth of a thin film on a crystalline substrate as a result of thermochemical vapor phase reactions. In the case of the process of Linden the deposition can take place on an amorphous substrate as well a crystalline substrate.

In the process of Linden, the precursor molecules are dissociated as disclosed at page 5, lines 13-21:

> The different constituents or components of a hybrid coating according to the invention are preferably formed from precursor molecules in a process of precursor activation. During this activation, the precursor molecules are dissociated. Dissociation of the precursors can be done by means of thermal dissociation, laser dissociation or other suitable methods that are known in the art. A particular preference is expressed for a method whereby the precursor molecules are activated by means of a plasma. According to the present invention, with great preference, the activation of the organic and inorganic precursors takes place in separate plasmas.

Linden provides for the deposition of a coating comprising an inorganic and an organic component, in which the inorganic component comprises nanoparticles. These nanoparticles are formed through substantially complete dissociation of the inorganic precursors as disclosed at page 6, lines 15-25:

> "For the formation of the nanoparticles, preferably a part of the inorganic component is deposited in the form of nanoparticles. These nanoparticles are formed through substantially complete dissociation of the inorganic precursors, such as, for instance, the metal or silicon alkoxydes, and condensation of activated molecules to virtually crystalline nanoparticles. Once captured and covalently bound, or not, in the hybrid coating, these nanoparticles offer the advantage that they impart very high scratch resistance to the hybrid coating. Preferably, in an embodiment according to the present invention, nanoparticles are formed having a diameter between 1 and 200 nm. With greater preference, the nanoparticles possess a diameter between 1 and 50 nm."

Here dissociation of the precursors takes place and the precursors are not oligomers as in the case of the ORMOCER® lacquer disclosed in Haas.

As discussed in the previous response, Linden defines a plasma source to mean an electric power source and the electrodes for generating an electric field as well as the space limited by this field, for discharge and activation of a gaseous or vaporous composition at page 10, lines 6-10:

> "In a wider sense, plasma source in the present invention is understood to mean an electric power source and the electrodes for generating an electric field as well as the space limited by this field, for discharge and activation of a gaseous or vaporous composition of constituents and any physical separation present."

Linden does not disclose or suggest a dielectric barrier between the two electrodes and hence does not disclose or suggest a dielectric barrier discharge configuration. Nowhere in Linden is it disclosed or suggested to substitute chemical vapor deposition with a dielectric barrier discharge technique. Furthermore, neither Linden nor Haas disclose or suggest aerosols containing hybrid organic/inorganic cross-linked pre-polymers formed via sol-gel processing.

Moreover, even if the teaching of Haas could be combined with the vapor deposition technique of Linden, the oligomers of the ORMOCER® lacquer disclosed in Haas would not lend themselves to evaporation and dissociation and hence the ORMOCER® lacquer would not be suitable for/compatible with the chemical vapour deposition process of Linden. Therefore, one of skill in the art would not have been motivated to combine Haas and Linden as suggested in the Office Action.

At page 3, the Office Action alleges "Linden teaches that almost any organic substances can be used as the precursor (page 7, lines 8-12) including organosilicon previously polymerized compounds, which can supply both the inorganic and organic components of the deposited material (page 9, lines 1-14). Applicants do not agree and submit the Office Action is misconstruing the disclosure in Linden.

Linden at page 7, lines 8-12 discloses:

> "As precursor for an organic component, a multiplicity of organic compounds can be used. In fact, basically all conceivable <u>organic</u> substances can be activated as precursor in the organic plasma, and the components that are formed therefrom can be used in coatings according to the present invention." (emphasis added)

Linden therefore confines the disclosure to organic compounds, which excludes polymers. Moreover, Linden at page 9, lines 1-1discloses that:

> "Organosilicon compounds, such as polydimethylsiloxanes (PDMS) with terminal trimethylsiloxy, hydroxy or hydride groups, hexamethyldisilazane (HMDSN), hexamethyldisiloxane (HMDSO), 1,3-divinyltetramethyl disiloxane (DVS), vinylpentamethyldisiloxane (VPMDSO), 1, 1, 3,3-tetramethyldisiloxane (TMDSO), 1,3, 5,7-tetramethyl cyclotetrasilane (TMTSO), 2,4, 6, 8-tetravinyl-2, 4,6, 8-tetramethylcyclotetrasiloxane (TVTMTSO), diacetoxy-di-tert-butoxysilane (DADBS), triethoxysilane (TRIES) methyltrimethoxysilane (MTS), 1, 2-bis (trimethylsilyloxy) ethane (TMSE), tetramethoxysilane (TMOS), tetraethoxysilane (TEOS), octamethyltrisiloxane (OMCTS), or tripropylsilane (TPS), organometal compounds and metal organic compounds also find very suitable application in embodiments according to the present invention and can be used with advantage as precursor of the organic as well as of the inorganic component)."

Linden therefore does not disclose or suggest that organosilicon includes the use of polymers, i.e.polymerized compounds.

It is well established that "a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention." MPEP § 2141.02 citing WL. *Gore & Associates, Inc. v. Garlock, Inc.,* 721 F.2d 1540 (Fed. Cir. 1983) *cert. denied,* 469 U.S. 851 (1984). It is improper to combine references where the references teach way from their combination. MPEP § 2145(X)(D)(2) citing *In re Grasselli,* 713 F.2d 731, 743 (Fed. Cir. 1983). If a proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. MPEP § 2144(VI) citing *In re Ratti,* 270 F.2d 810 (CCPA 1959).

The use of polymerized compounds in Linden would be inconsistent with the substantial dissociation thereof needed to form inorganic nano-particles. The coating disclosed in Linden includes an inorganic and an organic component, which inorganic component comprises nanoparticles. The starting material disclosed in Linden is therefore not a prepolymer in an aqueous layer, but compounds such as 1, 2- bis (trimethyl-silyloxy) ethane (TMSE), tetraethoxysilane (TEOS) and tri-n- propylsilane (TPS). These nanoparticles are formed through substantially complete dissociation of the inorganic precursors as disclosed at page 6, line 15 to 20:

> "For the formation of the nanoparticles, preferably a part of the inorganic component is deposited in the form of nanoparticles. These nanoparticles are formed through substantially complete dissociation

of the inorganic precursors, such as, for instance, the metal or silicon alkoxydes, and condensation of activated molecules to virtually crystalline nanoparticles."

Furthermore, the inorganic nanoparticles in Linden form inorganic islands in a sea of organic material, contrary to the situation with the ORMOCER's of the present invention in which inorganic and organic components react with one another to form a homogeneous composition which is deposited integrally on the substrate (i.e., without dissociation). In contrast to the claims, Linden discloses a chemical vapour deposition process in which the inorganic precursors are completely dissociated and form nanoparticles in the plasma (i.e., are present in the deposited layers as inorganic islands), which is completely different from the coating of ORMOCER layers in the claims. Therefore, one of skill in the art would not have had a reason to combine Linden with Haas as suggested in the Office Action or had a reasonable expectation of successfully arriving at the claims.

At page 4, the Office Action acknowledges that Linden does not disclose a dielectric barrier discharge plasma. However, the Office Action alleges it would have been obvious to one of skill in the art to use a dielectric barrier discharge process as disclosed by Goodwin in the process of Haas in view of Linden. Applicants do not agree.

The secondary Goodwin reference does not cure the deficiencies of the combination of Haas and Linden, especially in veiw of the fact that the oligomers of Haas would not be suitable for the process of Linden. Goodwin discloses an atmospheric pressure plasma assembly and methods for treating a substrate using the disclosed assembly (see generally Goodwin at paragraph [0011]). The assembly includes a first and second pair of vertically arrayed, parallel spaced-apart planar electrodes with at least one dielectric plate between said first pair, adjacent one electrode and at least one dielectric plate between said second pair adjacent one electrode. The spacing between the dielectric plate and the other dielectric plate or electrode of each of the first and second pairs of electrodes forms a first and second plasma region. The assembly further includes a means of transporting a substrate successively through said first and second plasma regions and an atomizer adapted to introduce an atomized liquid or solid coating making material into one of said first or second plasma regions (see Goodwin at paragraph [0019]). Goodwin is silent with respect of the thickness of the layers produced.

Goodwin discloses an extensive list of monomeric or oligomeric materials that can be atomized in the disclosed methods. See Goodwin at paragraphs [0039] and [0040]. Goodwin discloses an atmospheric DBD plasma process in which liquid droplets produced by atomizing a liquid and/or a solid is introduced into an atmospheric DBD plasma which contemplates that the atomized liquid is monomers, oliogomers, metal alkoxides, metals, metal oxides or conducting polymers. Notably, Goodwin does not disclose or suggest injection of hybrid organic/inorganic cross-linked pre-polymers formed via sol-gel processing into DBD plasma or the vapour phase coating of ORMOCER layers.

Absent Applicants' disclosure, one of skill in the art would not have a reason to use a DBD process as taught in Goodwin in the process of Haas in view of Linden. Haas only discloses the provision of ORMOCER® layers by conventional coating processes such as dip-coating, spray-coating and spin-coating, and there is no teaching or sugeestion in any of the cited references that the oligomers of Haas could be employed in either the vapor depostion technique of Linden or the technique of Goodwin .

Linden does not disclose or suggest the integral deposition of a prepolymerized ORMOCER starting material on a substrate and the language in Linden exclused the use of a prepolymer (i.e., a partially polymerized composition) in the plasma. In Linden, any inorganic precursors present in the plasma are substantially dissociated and form nanoparticles in the plasma. If these nanoparticles are present in the deposited layers, they are present as inorganic islands thereby providing a heterogenous layer and not a homogenous layer as provided by the claimed method. Any inorganic precursors present in the plasma in Linden are completely dissociated and form nanoparticles in the plasma, i.e. are not present in the deposited layers.

Finally, Goodwin also fails to disclose ORMOCER layers. Goodwin discloses an atmospheric DBD plasma process in which liquid droplets produced by atomizing a liquid and/or a solid is introduced into an atmospheric DBD plasma which contemplates that the atomized liquid is monomers, oligomers, metal alkoxides, metals, metal oxides or conducting polymers.

None of the references, alone or in combination, disclose or suggest the claimed method of vapor phase coating of ORMOCER layers.

Claims 2-7 and 9-13 depend directly or indirectly from claim 1 and are therefore patentable over the combination of Haas, Linden, and Goodwin for the same reasons as claim 1.

In view of the forgoing, Applicants submit the Office Action has failed to establish a *prima facie* case of obviousness because (1) the cited combination of references fails to disclose or suggest all the elements of the claims, (2) the Office Action fails to establish, absent Applicants' disclosure, that one of skill in the art would havehad a reason to combine the references , and (3) the Office Action fails to establish that one of skill in the art in view of the cited combination of references had a reasonable expectation of successfully arriving at Applicants' claims. Withdrawal of the rejection is respectfully requested.

2. Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Haas in view of Linden in view of Goodwin in further view of Chow (U.S. 200202031658). Applicants respectfully traverse this rejection.

Claim 3 depends from claim 1. Claim 1 is patentable over the combination of Haas, Linden, and Goodwin for the reasons discussed above. The Chow reference does not cure the deficiencies of the combination of Haas, Linden, and Goodwin.

Chow describes spray deposition of liquid precursor coating material onto a substrate (see Chow, for example, at paragraph [0013]). Similar to Haas, Linden, and Goodwin, Chow does not disclose or suggest vapor phase coating of ORMOCER layers. The cited combination of references therefore fails to disclose or suggest all the elements of claim 1 or claim 3. Withdrawal of the rejection is respectfully requested.

SUMMARY

In view of the above remarks, Applicants respectfully request a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.

Please consider this a PETITION FOR EXTENSION OF TIME for a sufficient number of months to enter these papers or any future reply, if appropriate. Please charge any additional fees or credit overpayment to Deposit Account No. 13-2725.

Respectfully submitted,

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